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(71) Applicant *(for all designated States except US)*: EFUSION, INC. [US/US]; 15236 N.W. Greenbrier Parkway, Beaverton, OR 97006 (US).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: MIRASHRAFI, Mojtaba [US/US]; 15007 N.W. Germantown Road, Portland, OR 97231 (US). BUONDONNO, Michael, F. [US/US]; 16772 S.W. Nafus Lane, Beaverton, OR 97007 (US). ELLIOTT, John, D. [US/US]; 8427 N.W. Skyline Boulevard, Portland, OR 97229 (US). KEELER, Kenneth, L. [US/US]; 17013 N.W. Johnson Road, Hillsboro, OR 97124 (US). PIRKL, Keith, A. [US/US]; 1000 W. 43rd, Vancouver, WA 98660 (US). SIMON, Al, J. [US/US]; 967 N.W. First Place, Hillsboro, OR 97124 (US). TAYLOR, George, L. [US/US]; 10965 S.W. 78th Avenue, Tigard, OR 97223 (US). ZUBER, Mark, D. [US/US]; 17919 N.W. Cambray, Beaverton, OR 97006 (US).

(74) Agents: AUYEUNG, Al et al.; Blakely, Sokoloff, Taylor & Zafman, 7th floor, 12400 Wilshire Boulevard, Los Angeles, CA 90025–1026 (US).

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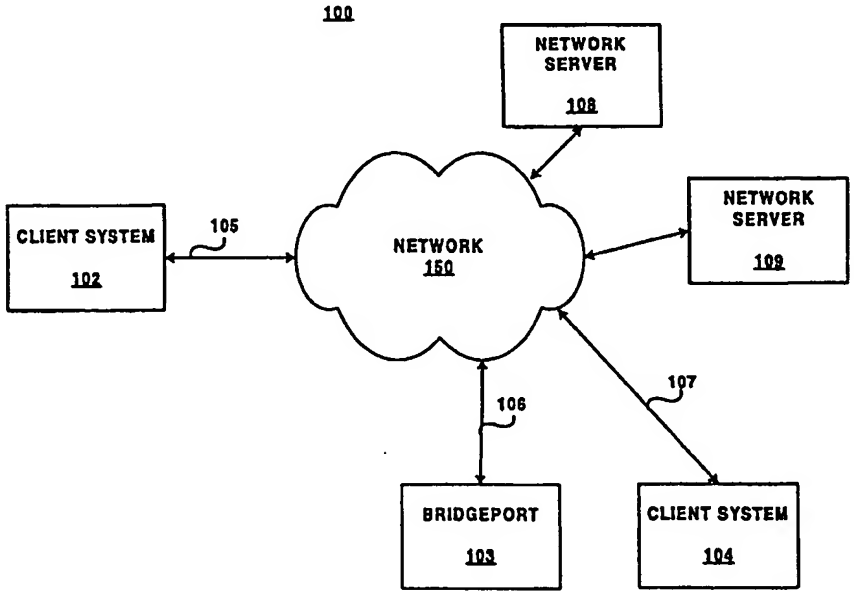

(57) Abstract

In accordance with a method and apparatus (100) for synchronizing information browsing among multiple systems (108 and 109), a bridgeport system (103) receives identifiers for data requests received over networks (150, 105, 106 and 107) on a first hardware system (102) and automatically transmits the identifier of the requested data to one or more additional hardware systems (104). Each of these one or more additional hardware systems then retrieves the identified data, thereby keeping the data being provided in these hardware systems in synchronization.

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METHOD AND APPARATUS FOR SYNCHRONIZING INFORMATION BROWSING AMONG MULTIPLE SYSTEMS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to the field of telecommunications and, in particular, to a method and apparatus for synchronizing information browsing in a network environment.

2. Background Information

As computer technology has advanced the use of networks has continually increased. A network refers to a system which can couple together two or more computer systems such that the computer systems can communicate with one another. One current network which has recently gained widespread popularity is the Internet, which is a global network allowing individuals throughout the world to communicate with one another.

Communication over the Internet is typically between two computer systems referred to as a client system and a host system. The host system (also referred to as a web server) is the content provider. In other words, content (also referred to as information or data) is provided by the host system to the client system. Host systems often store a large amount of content, with the specific content to be provided to a particular client system being dependent on the request(s) of the client system.

One currently popular use of the Internet is to provide corporate information or content delivery to individual users. Various companies connect host systems to the Internet

and make information regarding the company, such as its products and/or services, available to anyone using a client system. Given that many individuals are already accessing host systems to obtain more information about company products and services, it would be beneficial to provide a way to enhance an individual's ability to purchase and/or inquire about products and/or information he or she discovers on the host system. For example, it would be useful to provide a way for a sales agent of a corporation using one computer system to actively assist in the browsing and/or purchasing of products by an individual using a client system to access the corporation's host system.

As will be described in more detail below, the present invention provides a method and apparatus for synchronizing network browsing among multiple systems which achieves these and other desired results which will be apparent to those skilled in the art from the description that follows.

SUMMARY OF THE INVENTION

A method and apparatus for synchronizing information browsing among multiple systems is described herein. In accordance with the present invention, a bridgeport system receives identifiers for data requests received in a first hardware system and automatically transmits the identifier of the requested data to one or more additional hardware systems. Each of these one or more additional hardware systems then retrieves the identified data, thereby keeping the data being provided in these hardware systems in synchronization.

According to one embodiment, the present invention also facilitates a voice telephone connection to be established between the first hardware system and a telephone set associated

with a synchronization partner hardware system while the first hardware system and the additional hardware systems are still enabled to receive requested data synchronously.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be described by way of exemplary embodiments, but not limitations, illustrated in the accompanying drawings in which like references denote similar elements, and in which:

Figure 1 is a block diagram of a network environment illustrating synchronized information browsing between multiple systems according to one embodiment of the present invention;

Figure 2 is a flowchart illustrating the steps for requesting data from a network server according to one embodiment of the present invention;

Figure 3 is a flowchart illustrating the steps followed by a synchronization participant in receiving data in a synchronized manner according to one embodiment of the present invention;

Figure 4 is a block diagram illustrating an exemplary communication system such as may be used with one embodiment of the present invention;

Figure 5 is a flowchart illustrating the steps followed in establishing synchronized browsing according to one embodiment of the present invention;

Figure 6 is a block diagram illustrating the hardware elements of an exemplary computer server according to one embodiment of the present invention; and

Figure 7 is a block diagram illustrating the software elements of an exemplary computer server according to one embodiment of the present invention.

DETAILED DESCRIPTION

In the following description, for purposes of explanation, specific numbers, materials and configurations are set forth in order to provide a thorough understanding of the present invention. However, it will be apparent to one skilled in the art that the present invention may be practiced without the specific details. In other instances, well known features are omitted or simplified in order not to obscure the present invention. Furthermore, for ease of understanding, certain method steps are delineated as separate steps, however, these separately delineated steps should not be construed as necessarily order dependent in their performance.

Some portions of the detailed descriptions which follow are presented in terms of algorithms and symbolic representations of operations on data bits within a computer memory. These algorithmic descriptions and representations are the means used by those skilled in the data processing arts to most effectively convey the substance of their work to others skilled in the art. An algorithm is here, and generally, conceived to be a self-consistent sequence of steps leading to a desired result. The steps are those requiring physical manipulations of physical quantities. Usually, though not necessarily, these quantities take the form of electrical or magnetic signals capable of being stored, transferred, combined, compared, and otherwise manipulated. It has proven convenient at times, principally for reasons of common usage, to refer to these signals as bits, values, elements, symbols,

characters, terms, numbers, or the like. It should be borne in mind, however, that all of these and similar terms are to be associated with the appropriate physical quantities and are merely convenient labels applied to these quantities. Unless specifically stated otherwise as apparent from the following discussions, it is appreciated that throughout the present invention, discussions utilizing terms such as "processing" or "computing" or "calculating" or "determining" or "displaying" or the like, refer to the action and processes of a computer system, or similar electronic computing device, that manipulates and transforms data represented as physical (electronic) quantities within the computer system's registers and memories into other data similarly represented as physical quantities within the computer system memories or registers or other such information storage, transmission or display devices.

Figure 1 is a block diagram of a network environment illustrating synchronized information browsing between multiple systems according to one embodiment of the present invention. Network environment 100 includes client systems 102 and 104, a network 150, network servers 108 and 109, and a bridgeport 103, coupled together as shown.

Client systems 102 and 104 aided by bridgeport 103 of the present invention are engaged in synchronized browsing of the information available from network servers 108 and 109. Logical connections for exchanging information identifiers are established between each of client systems 102 and 104 and bridgeport 103 using communications links 105, 106, 107, and network 150. These logical connections allow an information identifier to be passed from one of the systems to the other via bridgeport 103 whenever the "current" information identifier changes on one of the systems. In the illustrated embodiment, whenever client system 102 initiates access for a new page of information from one of the servers 108 or 109,

client system 102 also sends the identifier of the new page to the bridgeport 103, which in turn forwards the identifier to client system 104. Client system 104 in turn accesses the new page as well, thereby keeping the client systems synchronized. Similarly, identifiers for new pages of information accessed by client system 104 are forwarded to client system 102, resulting in client system 102 staying in synchronization with client system 104.

Network 150 can be any of a wide variety of conventional networks, including the Internet or an Intranet. In one embodiment, network 150 supports the HyperText Transmission Protocol (HTTP) and communicates with client systems 102 and 104, network servers 108 and 109, and bridgeport 103 using HTTP connections.

Network servers 108 and 109 store the content being provided to hardware systems such as client systems 102 and 104. In one embodiment, this content is one or more HyperText Markup Language (HTML)-compatible web pages which can be browsed as part of the world wide web, and the information identifiers are uniform resource locators (URLs).

Client systems 102 and 104 are intended to represent a broad range of hardware systems which can be coupled to network 150. In the illustrated embodiment, client systems 102 and 104 execute web browser software complemented with URL monitoring functions. The web browser software allows the user of client systems 102 and 104 to retrieve and view the content stored at network servers 108 and 109. The URL monitoring functions ensure that the web browser software stays in synchronization with each other.

Bridgeport 103 facilitates information identifier exchanges between client system 102 and client system 104 so that systems 102 and 104 are synchronized to provide the same content. In one embodiment, bridgeport 103 maintains a database of current synchronized systems.

It is to be appreciated that additional components can be added to network environment 100, components can be removed from network environment 100, and components of network environment 100 can be combined. By way of example, network environment 100 may include multiple additional client systems or bridgeports coupled to network 150, or only a single network server, or bridgeport 103 could be combined with either a network server or a client system.

Figure 2 is a flowchart illustrating the steps for requesting data from a network server according to one embodiment of the present invention. The browser at the client system receives a new information identifier from the user, step 205. In the illustrated embodiment, this new information identifier is a new URL identifying a new web page. It is to be appreciated that this new information identifier can be input by a user in any of a wide variety of manners, such as direct input (e.g., typing) or selection of a link on a page being viewed by the user (e.g., a hypertext link).

Upon receipt of the information identifier, the browser requests the new page from the identified web server, placing the URL onto network 150, step 210. In due course, the browser receives the requested page in a conventional manner. Simultaneously, the URL monitoring function, detecting the new URL in the browser, forwards the URL of the requested page to the bridgeport, which in turn forwards the URL to the other synchronization participants connected to the same bridgeport, step 215. Thus, whenever the user of the client system requests content from a different page, the URL of that different page is forwarded to the other synchronization participants, thereby allowing each of them to retrieve the page from the web server and synchronizing all participants to the same page. In one embodiment, the browser was launched by the URL monitoring function. Additionally,

it is to be appreciate that because each synchronization participant is responsible for retrieving the page from the web server, the page will not be displayed at exactly the same time to all synchronization participants. However, it will be displayed at approximately the same time.

It should be noted that a race condition can occur at the bridgeport by multiple synchronization participants sending URLs to the bridgeport at approximately the same time. The bridgeport forwards URLs received from synchronization participants to the other synchronization participants in the order that the URLs are received. Thus, the race condition is resolved by the last URL received at the bridgeport indicating the content to which the synchronization participants will be synchronized.

It should also be noted that different systems may cache content from web servers differently. This caching may be done, for example, either locally by the hardware system itself or externally by a proxy. Thus, situations may arise where the hardware system retrieves the content from the cache rather than by actually accessing the web server again to retrieve the content.

It should also be noted that the bridgeport can support multiple concurrent synchronization sessions with different participants in each session. In one implementation, the bridgeport maintains a record of each participant in each synchronization session it is handling. Additionally, the bridgeport also maintains a record of which URLs. if any, are waiting to be forwarded to which participants at any given moment.

Figure 3 is a flowchart illustrating the steps followed by a synchronization participant in receiving data in a synchronized manner according to one embodiment of the present invention. The monitor function of a synchronization participant receives an information

identifier from the bridgeport, step 305. In the illustrated embodiment, this identifier is a new URL provided to the bridgeport by a synchronization partner in step 215 of Figure 2. The monitor function "stuffs" the received URL into the browser of the synchronization participant, step 310. The "stuffing" of the URL into the browser is treated by the browser as any other input of a page request by a user. Thus, the browser requests the identified page from the identified web server, placing the "stuffed" URL onto network 150, step 315. In due course, the synchronization participant receives the requested page from the web server, keeping the synchronization participant in synchronization with its partners.

In the discussions above, reference is made to the identifier of a requested page being an URL. However, it is to be appreciated that other identifiers can be used within the spirit and scope of the present invention. In any case, those skilled in the art will appreciate that the above described exchanges of information identifiers imposes a significantly smaller burden on the participants and the bridge as compared to transferring the object data from one participant to another participant. Thus, the present invention achieves synchronization in a much more efficient manner, which makes it possible for the bridgeport to synchronize a large number participants.

Referring now to Figure 4, a block diagram is presented illustrating an exemplary communication system 400 incorporating the teachings of the present invention for synchronizing information browsing among two systems in conjunction with placing a voice call from one of the systems to a telephone handset associated with the other system. While the present invention will be described in the context of this exemplary communication system, based on the descriptions to follow, those skilled in the art will appreciate that the present invention is not limited to this embodiment, and may be also practiced with an

Intranet (in lieu of the Internet). In one implementation, client system 402, web server 428, client system 416, and bridgeport 465 of Figure 4 are client system 102, network server 109, client system 104, and bridgeport 103 of Figure 1, respectively. Handset 442 is associated with client system 416.

For the illustrated embodiment, client system 402 incorporated with the teachings of the present invention, while in data communication with a web server, e.g. web server 428, through PSTN 440 and Internet 450, is presented with a Push-To-Talk™ option by the web server 428. Push-To-Talk is a trademark of eFusion™, Inc. of Beaverton, Oregon. When client system 402 selects the Push-To-Talk™ option, bridgeport 462 of the present invention automatically determines the PSTN extension of telephone handset 442 as the appropriate destination PSTN extension, as well as an appropriate one of the community of bridgeports 462 and 465 to place the voice call to the PSTN extension and facilitate the voice call between the user of client system 402 and the user of telephone handset 442. The Push-To-Talk™ option is pre-associated with bridgeport 462 by web server 428, and the determination of the destination PSTN extension by bridgeport 462 is made in accordance with one or more attributes of web server 428, such as the identity of web server 428, and optionally, one or more attributes of client system 402, such as the zip code of the area in which client system 402 is located.

Client system 402, web servers 420 and 428, bridgeports 462 and 465, and handset 442 are communicatively coupled to each other by way of PSTN 440 and Internet 450 as shown. More specifically, client system 402 is coupled to Internet 450 by way of an Internet service provider (ISP) 412. Client system 402 is coupled to ISP 412 through PSTN extension 404, communication line 406 and PSTN 440. In other words, for the illustrated embodiment,

client system 402 includes a modulation/demodulation (MODEM) device (not shown) coupled to PSTN extension 404. However, a client computer may be coupled to ISP 412 through a network connection using a network interface instead, such as client computer 408 using network connection 410. Alternatively, a client computer may also be directly coupled to Internet 450 such as client computer 416 using direct connection 418.

Web servers 420 and 428 are coupled to Internet 450 through connections 422 and 430. Although not illustrated, web servers 420 and 428 may also be coupled to PSTN 440. Similarly, bridgeports 462 and 465 of the present invention are coupled to Internet 450 through connections 464 and 467. Bridgeports 462 and 465 are also coupled to PSTN 440 through communication lines 463 and 466 respectively. Handset 442 is coupled to PSTN 440 through PSTN extension 443 and communication line 444.

Communication lines 406, 415 and 444 may simply be plain old telephone service (POTS) communication lines, although other types of communication lines may be used. For examples, in the case of communication line 406, it may be an integrated service digital network (ISDN) line, whereas in the case of communication line 415, it may be a T1 (1.533 Mbps) or an E1 (2.0488 Mbps) trunk line. In the case of communication line 444, it may be a wireless cellular connection.

PSTN 440 includes a number of Service Switching Points (SSP), Signal Transfer Points (STP), and Service Control Points (SCP) coupled to each other (not shown). PSTN extension 404 through communication line 406 is coupled to a "local" SSP, which in turn is coupled to a number of other "local" PSTN extensions, including e.g. PSTN extension 413 if ISP 412 is a "local" ISP served by the same SSP. In addition, the "local" SSP is also coupled to an associated STP, which in turn is coupled to other "remote" SSPs. Each of the "remote"

SSPs is coupled to a number of "remote" PSTN extensions, including e.g. extension 443, if handset 442 is a "remote" handset served by a "remote" SSP. As is well known in the art, Internet 450 includes a number of networks interconnected by routers, interconnecting the various client computers, web servers and bridgeports together. It is to be appreciated that Internet 450 may be a private Intranet instead.

Except for the incorporated teachings of the present invention for synchronizing information browsing among multiple systems, client system 402 is intended to represent a broad category of computer systems known in the art. An example of such a computer system is a desktop computer system equipped with a high performance microprocessor, such as the Pentium® processor manufactured by Intel Corporation of Santa Clara, CA or the Alpha® processor manufactured by Digital Equipment Corporation of Manard, MA; a communication interface for sending and receiving various data packets (including audio data packets) in accordance with certain standard communication protocol, such as a V.42bis compliant modem or an Ethernet adapter card; a windows-based operating system including internetworking communication services providing support for Transmission Control Protocol/Internet Protocol (TCP/IP) (and other Internet Communication Suite protocols) and socket services, such as Windows™ 95 developed by Microsoft Corporation of Redmond, WA; and a web communications tool such as Navigator™, developed by Netscape Communications of Mountain View, CA.

In the illustrated embodiment, client system 402 is also equipped with a number of audio input and output peripherals/interfaces for inputting, digitizing and compressing outbound audio, and for decompressing and rendering inbound audio, and an Internet

telephony application, such as IPhone[1] developed by Intel Corporation. However, it is to be appreciated that alternate embodiments need not be so equipped.

In one embodiment, the teachings of the present invention which are the responsibility of the client system are incorporated in client system 402 in the form of a client bridgeport driver. The client bridgeport driver may be made available to client system 402 in a wide variety of manners. For example, the client bridgeport driver may be distributed via diskettes produced by a bridgeport vendor, or downloaded from a web server of the bridgeport vendor. In other embodiments, the teachings of the present invention are incorporated in the browser and/or the operating system of client system 402. For ease of understanding, the remaining descriptions will be presented in the context of the client bridgeport driver embodiment.

Except for the presentation of web pages having Push-To-Talk™ options pre-associated with the bridgeports of the present invention, web servers 420 and 428 are intended to represent a broad category of web servers, including e.g. corporate presence servers and government presence servers, known in the art. Any number of high performance computer servers may be employed as web servers 420 and 428, e.g. a computer server equipped with one or more Pentium® Pro processors from Intel Corp., running Microsoft's Windows® NT operating system, or a computer server equipped with one or more SPARC® processors from Sun Microsystems of Mountain View, CA, running Sun's Solaris® operating system.

Similarly, ISP 412 is intended to represent a broad category of Internet service providers. An ISP may be a "small" local Internet access provider, or one of a number of

[1] Note that it is not necessary for the Internet telephony application to explicitly support voice calls with PSTN handsets, as is the case with IPhone and many of the prior art internet telephony applications.

point of presence providers offered by a "large" ISP. It is also anticipated that ISP 412 may be incorporated with an SSP of PSTN 440. Handset 442 is intended to represent a broad category of conventional handsets known in the art, including but not limited to desktop handsets, cordless handsets, and wireless handsets. No special features are required of handset 442 for it to be called and connected to Internet telephony enabled client system 402, in accordance with the present invention. As described earlier, handset 442 may also be automated/computerized telephony answering equipment.

Before we proceed to describe bridgeports 462 and 465 in further details, it should be noted that one skilled in the art of, e.g., telecommunications, will appreciate that the communication system illustrated in Figure 4, is significantly more complex than what is depicted. For example, each SSP of PSTN 440 may service thousands of PSTN extensions, and there are numerous SSPs, STPs and SCPs in a common PSTN implementation. Internet 450 includes well over several hundred thousands of networks. Together, PSTN 440 and Internet 450 interconnects millions of client computers and web servers. Nonetheless, Figure 4 does capture a number of the more relevant components of a communication system necessary to illustrate the interrelationship between client system 402, web server 428, bridgeports 462 and 465, and handset 442, such that one skilled in the art may practice the present invention. Also, while the present invention is being described in the context of client system 402 being engaged in data communication with web server 428, as will be readily apparent from the description to follow, the present invention may be practiced with any "client" computer engaged in data communication with any "web" or "information" server.

Figure 5 is a flowchart illustrating the steps followed in establishing synchronized browsing according to one embodiment of the present invention. Initially, client system 416

acting as an agent system pre-registers itself with predetermined ones of the community of bridgeport(s) and establishes synchronization logical connections, step 505. The registration registers the agent system to become a synchronization partner to a client system who places a voice call to its associated telephone handset. This pre-registration occurs whenever the user of the agent system is ready to be a synchronization partner. The predetermined bridgeports could be any set of known bridgeports, such as the bridgeports owned by the corporation the agent works for. The bridgeport then waits for a request to place a voice call to the associated handset, step 510.

At some point in time after the agent system has pre-registered, the bridgeport driver of a client system sends a voice call to the page bridgeport, step 515. The voice call request processing includes the synchronization with the agent system associated with the selected telephone handset. This voice call/synchronization request can be initiated in any of a wide variety of manners. In one embodiment, the voice call/synchronization request is initiated as a result of the selection of a Push-To-Talk™ option present by the web server as described earlier. In the illustrated embodiment, the selection of a Push-To-Talk™ option results in a Push-To-Talk™ event being posted to a page bridgeport. The page bridgeport is the bridgeport to which the Push-To-Talk™ option is pre-associated. In response, the page bridgeport identifies itself to the client system and launches the client bridgeport driver. In one embodiment, in addition to initiating the voice call/synchronization request, the client bridgeport driver further launches a new browser instance to monitor its URLs.

Upon receiving the voice call/synchronization request, the page bridgeport selects a bridgeport that will be used to place the voice call and facilitate the synchronization, step 520. The selected bridgeport is referred to as the changeover bridgeport. In one embodiment, this

identification process involves soliciting information from various potential changeover bridgeports and determining which to use based on the solicited information. A discussion of automatic placement and facilitation of a telephone call to a PSTN extension from a networked client computer is disclosed in copending U.S. Patent Application No. <insert application serial number>, docket no. 002784.P003, filed contemporaneously with the present application, entitled, "Method and Apparatus for Establishing a Voice Call to a PSTN Extension for a Networked Client Computer", which is hereby fully incorporated by reference.

Once the page bridgeport identifies the changeover bridgeport that will be used, the page bridgeport registers the voice call/synchronization request with the changeover bridgeport, step 525. This registration identifies to the changeover bridgeport that it will be handling a voice call as well as facilitating synchronized browsing and allows the changeover bridgeport to reserve resources for the call and the synchronization. As part of the registration process, the changeover bridgeport returns an indication to the page bridgeport that the voice call/synchronized browsing has been successfully registered with the changeover bridgeport.

The page bridgeport then identifies the changeover bridgeport to the client system, step 530. This information includes the Internet address of the changeover bridgeport, thereby allowing the client bridgeport driver to place a packet based phone call from the client system to the changeover bridgeport as well as establishing the above described synchronization connection between the client system and the changeover bridgeport, step 535.

The changeover bridgeport then places a PSTN phone call to the agent's handset via the PSTN and bridges the two calls, as well as bridges the synchronization participants for synchronization browsing, step 540. Thus, a voice connection between the client system and the associated handset as well as synchronized browsing between the client system and the agent system are established.

In the illustrated embodiment, where HTTP connections are employed, the connections are maintained by periodically (e.g., every minute) sending "keep alive" messages to each of the systems involved in the synchronization. This allows each client system to keep its connection to the changeover bridgeport active.

The synchronization among the client system, the agent system, and the changeover bridgeport continues until either the client or the agent system terminates, step 545. The call can be terminated in any of a wide variety of manners, such as by one side hanging up the phone. A termination at one side causes the present invention at that side to send a "terminate" message to the changeover bridgeport.

It should be noted that although the client system establishes a voice connection as well as synchronized browsing with a changeover bridgeport, the client system is still able to establish other HTTP connections to the Internet for browsing. Thus, the client system is able to browse various web servers as well as communicate with the changeover bridgeport.

It should also be noted that although the agent system is described as pre-registering with one or more predetermined changeover bridgeport(s), in alternate embodiments, rather than pre-registering, the agent system may register with the changeover bridgeport after the voice call is received from the changeover bridgeport.

In summary, when used in conjunction with automatic placement of a voice call from a client system to a telephone handset associated with an agent system. the present invention allows a user of a client system to jointly browse web pages with an agent and at the same time be talking to the agent without having to provide or even have knowledge of the address of the agent system or the phone number of the agent's telephone handset.

It is to be appreciated, however, that the synchronized browsing of the present invention can occur without an accompanying voice call. It will be understood by those skilled in the art that steps analogous to those discussed above with reference to Figure 5 can be performed without the voice call to provide a synchronized browsing session.

Turning now to Figures 6 and 7, two block diagrams illustrating the hardware and software elements of an exemplary computer server 600 suitable to be employed as a bridgeport are depicted. As illustrated, exemplary computer server 600 is comprised of multiple processors 602a - 602n and memory subsystem 608 coupled to processor bus 604 as depicted. Additionally, computer server 600 is comprised of a second bus 610, a third bus 612 and a fourth bus 614. In one embodiment, buses 612 and 614 are Peripheral Component Interconnect (PCI) buses, while bus 610 is an Industry Standard Architecture (ISA) bus. PCI buses 612 and 614 are bridged by bus bridge 616, and bridged to ISA bus 610 and processor bus 604 by I/O controller 606. Coupled to PCI bus 612 are network interface 618 and display interface 620, which in turn is coupled to display 622. Coupled to PCI bus 614 is computer telephony interface (CTI) 624, PSTN interface 626 and SS7 Interface 628. Coupled to ISA bus 610 are hard disk interface 630, which in turn is coupled to a hard drive 632. Additionally, coupled to ISA bus 610. keyboard and cursor control device 634, which in turn is coupled keyboard 636 and cursor control device 638.

CTI interface 624 provides the necessary hardware to interface exemplary computer server 600 to telephony equipment, such as private branch exchange (PBX) equipment. PSTN interface 626 provides the necessary hardware to interface exemplary computer server 600 to a plurality of PSTN communication lines (e.g., T1, E1 or POTS), wherein the actual number of PSTN communication lines interfaced will be implementation dependent. Additionally, PSTN interface 626 provides advanced DSP-based voice, dual-tone multiple frequency (DTMF) and call progress functionality, which allows for downloadable DSP protocol and voice processing algorithms, thereby providing CODEC support locally on the interface. Examples of supported codecs include the Global System for Mobile Communications (GSM) codec and the ITU-T G.723.1 protocol codecs, the specification for which are commonly available from the GSM consortium and the International Telecommunications Union, respectively. Similarly, SS7 interface 628 provides the hardware necessary to interface exemplary computer server 600 with PSTN trunk lines (e.g., ISDN) supporting the out-of-band communication protocol (e.g., SS7)) used between PSTN network elements (i.e., SSP-SSP, SSP-STP, STP-SCP, etc.). In one embodiment, PSTN interface 626 is preferably an AG-T1™ (for U.S. implementations, while an AG-E1 may be seamlessly substituted for European implementations), while SS7 interface 628 is preferably the TX3000™, both of which, along with their accompanying software drivers, are manufactured by and commonly available from Natural MicroSystems of Natick, Massachusetts. Otherwise, all other elements, processors 602a - 602n, memory system 608 and so forth perform their conventional functions known in the art. Insofar as their constitutions are generally well known to those skilled in the art, they need not be further described.

From a software perspective, Figure 7 illustrates the software elements of exemplary computer server 600. In particular, exemplary computer server 600 is shown comprising an application layer consisting of a Bridgeport Management Driver 702, Hop-Off™ driver 704, and other drivers 706. Hop-Off™ is a trademark of eFusion™, Inc. of Beaverton, Oregon. Hop-Off™ driver 704, supported by Management Driver 702, optional drivers 706, abstracted service layer 708, and synchronization driver 742 implement the method steps of Figures 2, 3 and 5 that are the responsibility of the community of bridgeports (i.e., bridgeports 462, and 465 of Figure 4).

The Service Abstraction Layer (SAL) 708 is shown comprising SS7 services 710, CTI Services 711, Management Services 712, Connection Services 714, Streaming Services 716, and Data Services 718. The protocol/service layer is shown comprising Telephony Application Programming Interface (TAPI) 720, Telephony Connection Protocol 722, PSTN Data Interface 724, CODEC 726, Real Time (Streaming) Protocol 728, and HTTP server 734. Also shown in this "layer" are configuration management data 719 maintained by management service 712, and codec services 726 employed by streaming services 716. The driver layer is shown comprising SS7 driver 727, CTI driver 729, PSTN driver 730 and socket service 732. Data and control information are exchanged between these elements in the fashion depicted.

Within the context of the present invention, one purpose of SAL 708 is to provide an Application Programming Interface (API) for all the available bridgeport and related services in exemplary computer server 600. The API abstracts out the actual modules used for providing services such as connection establishment (714), streaming and data exchange services (716 and 718). Additionally, SAL 708 provides the common operation tools such as

queue management, statistics management, state management and the necessary interface between the plug-in services (i.e., drivers in the driver layer). SAL 708 is also responsible for loading and unloading the appropriate drivers as appropriate.

Connection service 714 includes a connection establishment and tear-down mechanism facilitating the interconnection to the PSTN 140. Additionally, for the illustrated embodiment, connection service 714 employs connection and compatibility services which facilitate interoperation between communication equipment that support industry standards, thereby allowing a variety of communication equipment manufactured by different vendors to be benefited from the present invention. Connection services 714 include, in particular, services for supporting standard video telephony, such as ITU-T's H.323 video telephony, and standard data communication, such as ITU-T's T.120 data communication protocol. Examples of the connection establishment and tear-down mechanisms supported by connection service layer 714 include opening and starting PSTN ports, call control, DTMF collection, and tone generation, to name but a few.

Streaming service 716 is responsible for interfacing with the components that provide the real-time streaming functionality for the multimedia data. Once the connection has been established between the connection points (i.e., PSTN, H.323, etc.), streaming service 716 will take over the management and streaming of data between the two connected parties, until the connection is terminated. Codec service 726 facilitates the above described compression and transmission of inbound call signals from handset 142 as well as decompression and transmission of outbound call signals from client computer 102.

Data service 718 is responsible for providing non real-time peer to peer (i.e., computer-computer) messaging and data exchange between exemplary computer server 600

and other Internet and perhaps PSTN based applications. Sending messages to exemplary computer server end-points (i.e., other similarly equipped bridgeports on the Internet) or other servers within the PSTN is accomplished via data service 718.

CTI services 711 service all communications and automatic call distribution (ACD) necessary for Private Branch Exchange (PBX) based systems. SS7 services 710 service all out of band communications with STPs and/or SCPs of PSTN 140.

PSTN driver 730 is equipped to accommodate particularized PSTN interfaces 626, whereas CTI driver 729 is equipped to support particularized ACD and PBX equipment. Similarly, SS7 driver 727 is equipped to support particularized SS7 interface 628.

Web server 740 is equipped to provide web service with the Internet. In one embodiment, web server 740 is a web server developed by Microsoft Corporation of Redmond, Washington. In the illustrated embodiment, synchronization driver 742 implements the synchronized information browsing at the bridgeport. Synchronization driver 742 maintains a record of which client systems are participants in which synchronization sessions. When a particular client system sends a new identifier to the bridgeport, the client system identifies itself as well as the URL which is to be synchronized. Synchronization driver 742 identifies which synchronization session the client system is a participant in, and forwards the passed URL to all the participants of that session.

In one embodiment, the portions of the method and apparatus for synchronizing information browsing among multiple systems discussed above which are implemented at the host bridgeport are implemented as a series of software routines which are synchronization driver 742 of Figure 7. These software routines comprise a plurality or series of instructions to be executed by a processor(s) in a hardware system, such as processors 602a - 602b of

Figure 6. Initially, the series of instructions are stored on a storage device, such as mass storage device 622. The instructions are copied from storage device 622 into memory subsystem 608 and then accessed and executed by one or more processor(s) 602a - 602b. In one implementation, these software routines are written in the C++ programming language. It is to be appreciated, however, that these routines may be implemented in any of a wide variety of programming languages. In alternate embodiments, the present invention is implemented in discrete hardware or firmware. For example, an application specific integrated circuit (ASIC) could be programmed with the above described functions of the present invention.

In several of the discussions above, the network environment is described as including the Internet. It is to be appreciated, however, that the present invention can be used with any type of network environment and is not limited to being used with the Internet. By way of example, the present invention could also be used within a local area network (LAN) or an Intranet.

In the discussions above, reference is made to placing a packet based phone call from the client system to a bridgeport, which in turn is converted into a PSTN voice call to a handset at the agent system. In alternate embodiments, the PSTN voice call can be placed to an Internet telephony application executing on the agent systems instead.

It should be noted that although the discussions above describe the transmitting of identifiers such as URLs between multiple systems, the present invention can be used to transfer any type of information identifier between multiple systems.

It should also be noted that although the discussions above describe the synchronized connection of two systems, any number of systems can be synchronized using the present

invention. For example, the agent system could "conference" in additional synchronization participants in any of a wide variety of manners. By way of another example, a client system could "conference" in additional participants in any of a wide variety of manners, such as by selecting additional Push-To-Talk™ options provided by the web server, such as "talk to sales representative", "talk to financing specialist", "talk to technical support", "talk to customer service", etc., any combination of which can be selected by the user. The synchronized connection of any additional participants is performed in the same manner as discussed above.

It is to be appreciated that any hardware system equipped with the client aspect of the present invention can initiate the synchronized connection between two or more hardware systems.

It is also to be appreciated that although some of the above discussions describe both synchronized browsing with information identifiers and a voice connection between systems, synchronized browsing does not require a voice connection.

Thus, the present invention provides a method and apparatus for synchronizing information browsing among multiple systems. An identifier of information requested by a particular hardware system is advantageously forwarded to other hardware systems which are part of a synchronization partnership, thereby allowing each agent in the synchronization partnership to obtain the requested information from its source. Additionally, in one embodiment, a voice telephone connection is advantageously established between the users of the hardware systems in the synchronization partnership, thereby advantageously allowing voice communication while the users are jointly browsing the pages and servers of the network.

Whereas many alterations and modifications of the present invention will be comprehended by a person skilled in the art after having read the foregoing description, it is to be understood that the particular embodiments shown and described by way of illustration are in no way intended to be considered limiting. References to details of particular embodiments are not intended to limit the scope of the claims.

CLAIMS

What is claimed is:

1. A method of synchronizing a plurality of hardware systems in a network environment, the method comprising the steps of:

(a) receiving an identifier of requested data from a first hardware system of the plurality of hardware systems; and

(b) transmitting the identifier to a second hardware system of the plurality of hardware systems in order to enable the second hardware system to retrieve the requested data.

2. The method of claim 1, wherein the receiving step (a) comprises the step of receiving a world wide web page Uniform Resource Locator (URL) from the first hardware system.

3. The method of claim 1, wherein the network environment includes the Internet.

4. The method of claim 1, further comprising the steps of:

facilitating establishing a voice telephone connection between the first hardware system and the second hardware system while the first hardware system and the second hardware system are still enabled to receive requested data.

5. The method of claim 1, further comprising the step of maintaining a registration database which identifies each hardware system in a synchronized connection.

6. The method of claim 1, further comprising the step of transmitting the identifier to one or more additional hardware systems of the plurality of hardware systems in order to enable each of the one or more additional hardware systems to retrieve the requested data.

7. A method of synchronizing data at a plurality of hardware systems coupled to a network, the method comprising the steps of:

(a) receiving an identifier of requested data;

(b) retrieving the requested data from a server coupled to the network which includes the requested data; and

(c) sending the identifier to each other system of the plurality of systems to enable each other system to retrieve the requested data.

8. The method of claim 7, wherein the receiving step (a) comprises the step of receiving the identifier from another system of the plurality of systems which is browsing the network.

9. The method of claim 7, further comprising the step of establishing a voice connection with another system of the plurality of systems while still coupled to the network and able to receive requested data from the server.

10. A method of synchronizing a plurality of hardware systems coupled to a network, the method comprising the steps of:

(a) a first system of the plurality of hardware systems receiving an identifier of requested data from a second system of the plurality of hardware systems; and

(b) the first system of the plurality of hardware systems automatically accessing a web server identified by the identifier.

11. The method of claim 10, wherein the identifier comprises a Uniform Resource Locator (URL).

12. An apparatus comprising:

an interface to provide a coupling to a network; and

control logic, coupled to the interface, operative to receive an identifier of requested data from a first hardware system of a plurality of hardware systems via the interface and also operative to transmit the identifier to a second hardware system of the plurality of hardware systems via the interface in order to enable the second hardware system to retrieve the requested data.

13. The apparatus of claim 12, wherein the network includes the Internet.

14. The apparatus of claim 12, further comprising a driver to facilitate establishing and maintaining a voice telephone connection between the first hardware system and the second

hardware system while the first hardware system and the second hardware system are still enabled to receive requested data.

15. The apparatus of claim 12, wherein the control logic is further operative to transmit the identifier to one or more additional hardware systems of the plurality of hardware systems in order to enable each of the one or more additional hardware systems to retrieve the requested data.

16. A computer-readable medium having stored thereon a plurality of instructions for synchronizing a plurality of hardware systems in a network environment, the plurality of instructions designed to be executed by a processor and to implement a function to:

receive an identifier of requested data from a first hardware system of the plurality of hardware systems; and

transmit the identifier to a second hardware system of the plurality of hardware systems in order to enable the second hardware system to retrieve the requested data.

17. The computer-readable medium of claim 16, wherein the plurality of instructions are further designed to implement a function to facilitate establishing a voice telephone connection between the first hardware system and the second hardware system while the first hardware system and the second hardware system are still enabled to receive requested data.

18. The computer-readable medium of claim 16, wherein the plurality of instructions are further designed to implement a function to maintain a registration database which identifies each hardware system in a synchronized session.

19. The computer-readable medium of claim 16, wherein the plurality of instructions are further designed to implement a function to transmit the identifier to one or more additional hardware systems of the plurality of hardware systems in order to enable each of the one or more additional hardware systems to retrieve the requested data.

20. A computer-readable medium having stored thereon a plurality of instructions for synchronizing data at a plurality of hardware systems coupled to a network, the plurality of instructions designed to be executed by a processor and to implement a function to:

receive an identifier of requested data;

retrieve the requested data from a server coupled to the network which includes the requested data; and

send the identifier to each other system of the plurality of systems to enable each other system to retrieve the requested data.

21. The computer-readable medium of claim 20, wherein the plurality of instructions designed to implement the function to receive the identifier comprise a plurality of instructions designed to receive the identifier from another system of the plurality of systems which is browsing the network.

22. The computer-readable medium of claim 20, wherein the plurality of instructions are further designed to facilitate establishing a voice connection with another system of the plurality of systems while still coupled to the network and able to receive requested data from the server.

23. The computer-readable medium of claim 20, wherein the identifier comprises a Uniform Resource Locator (URL).

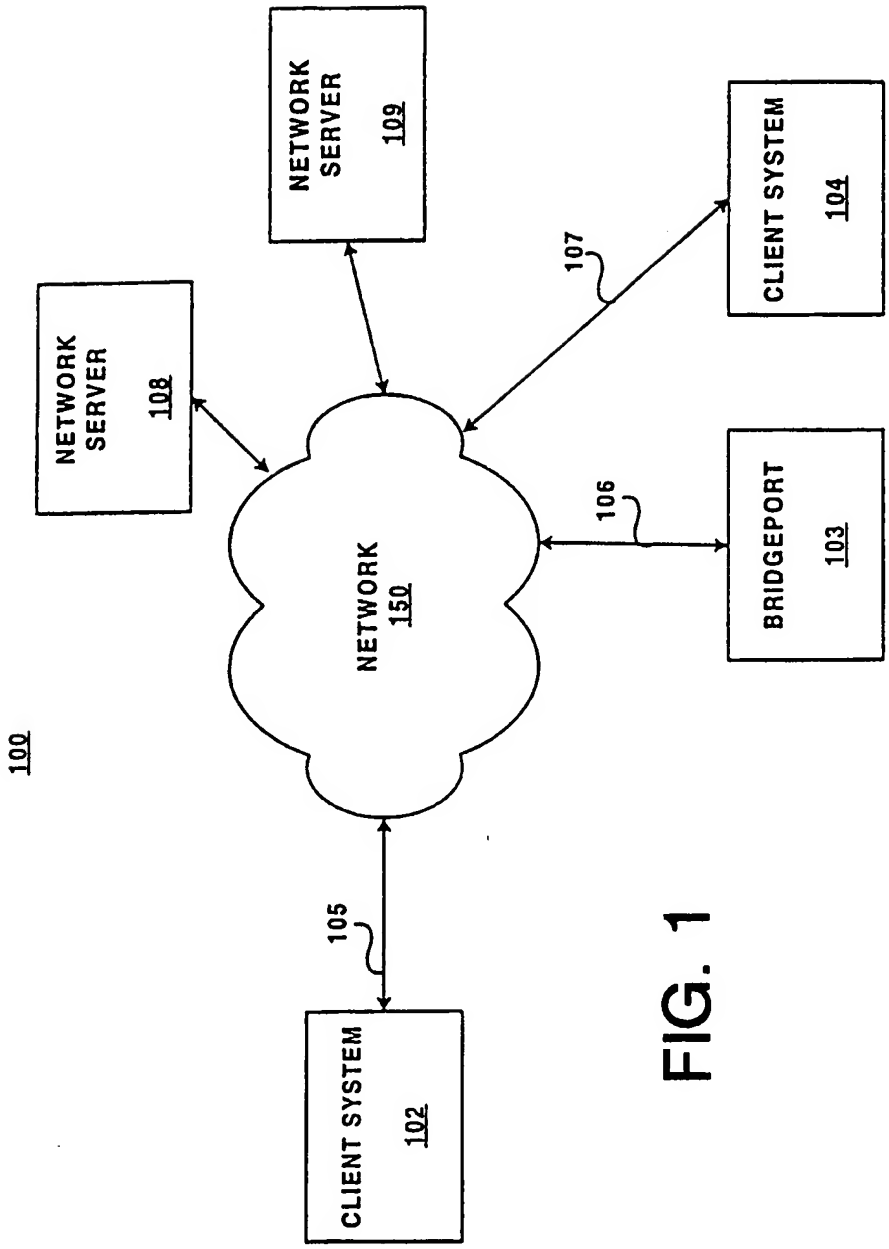
NETWORK SERVER 109
NETWORK SERVER 108
CLIENT SYSTEM 104
107
NETWORK 150
106
BRIDGEPORT 103
100
105
CLIENT SYSTEM 102

FIG. 1

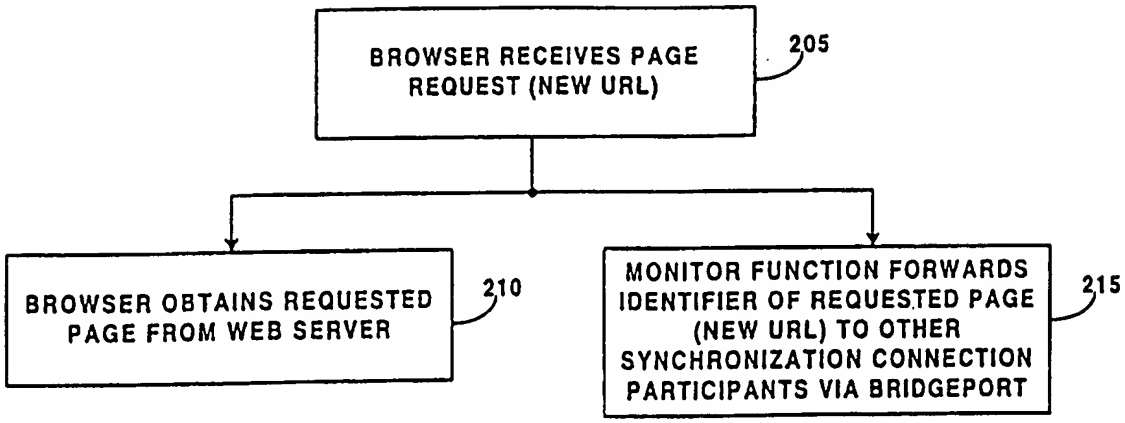
BROWSER RECEIVES PAGE REQUEST (NEW URL)
205
BROWSER OBTAINS REQUESTED PAGE FROM WEB SERVER
210
MONITOR FUNCTION FORWARDS IDENTIFIER OF REQUESTED PAGE (NEW URL) TO OTHER SYNCHRONIZATION CONNECTION PARTICIPANTS VIA BRIDGEPORT
215

FIG. 2

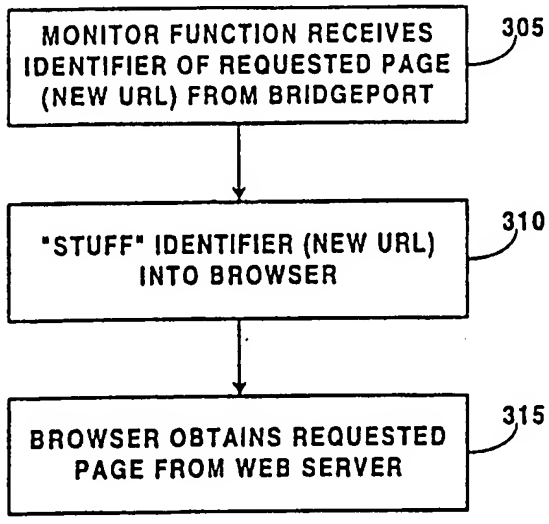
MONITOR FUNCTION RECEIVES IDENTIFIER OF REQUESTED PAGE (NEW URL) FROM BRIDGEPORT
305
"STUFF" IDENTIFIER (NEW URL) INTO BROWSER
310
BROWSER OBTAINS REQUESTED PAGE FROM WEB SERVER
315

FIG. 3

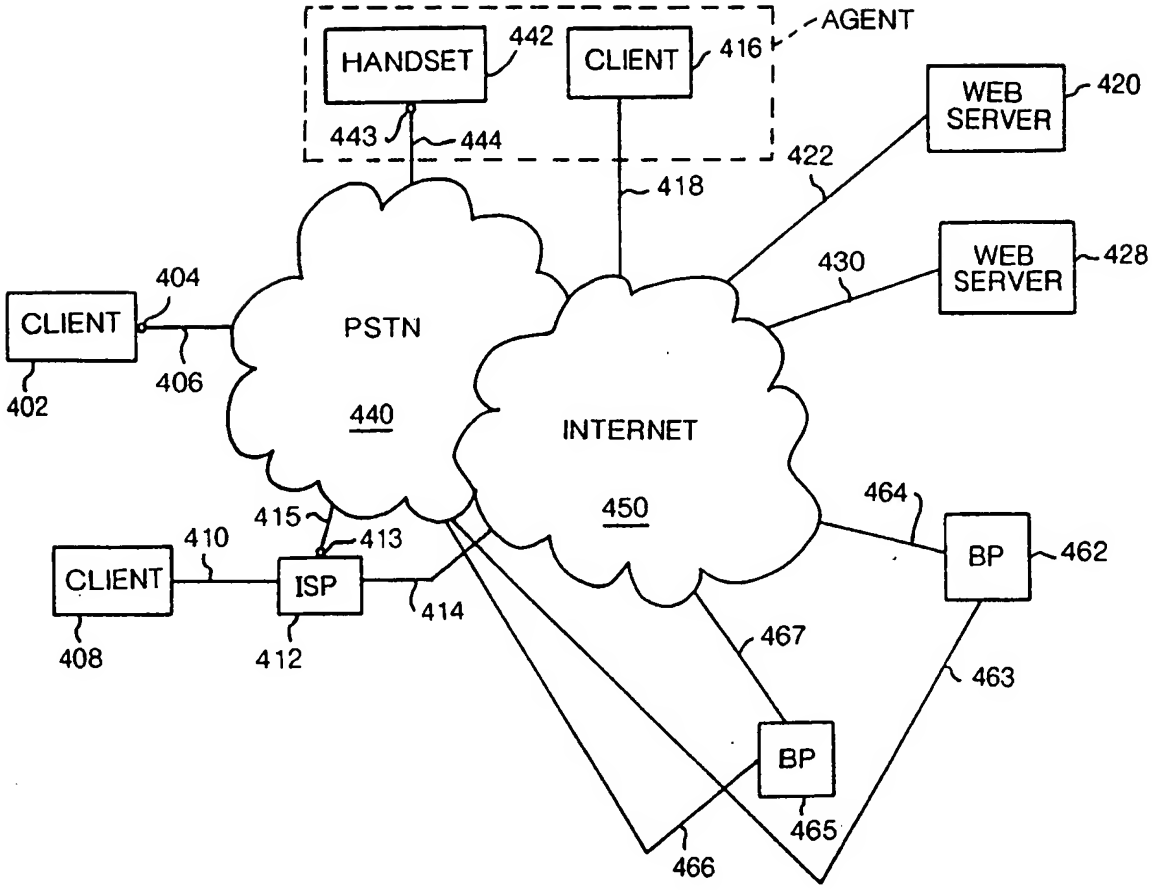
AGENT
HANDSET
442
CLIENT
416
443
444
418
WEB SERVER
420
422
430
WEB SERVER
428
CLIENT
404
406
402
PSTN
440
INTERNET
450
415
413
410
CLIENT
ISP
414
408
412
464
BP
462
467
463
BP
465
466

FIG. 4

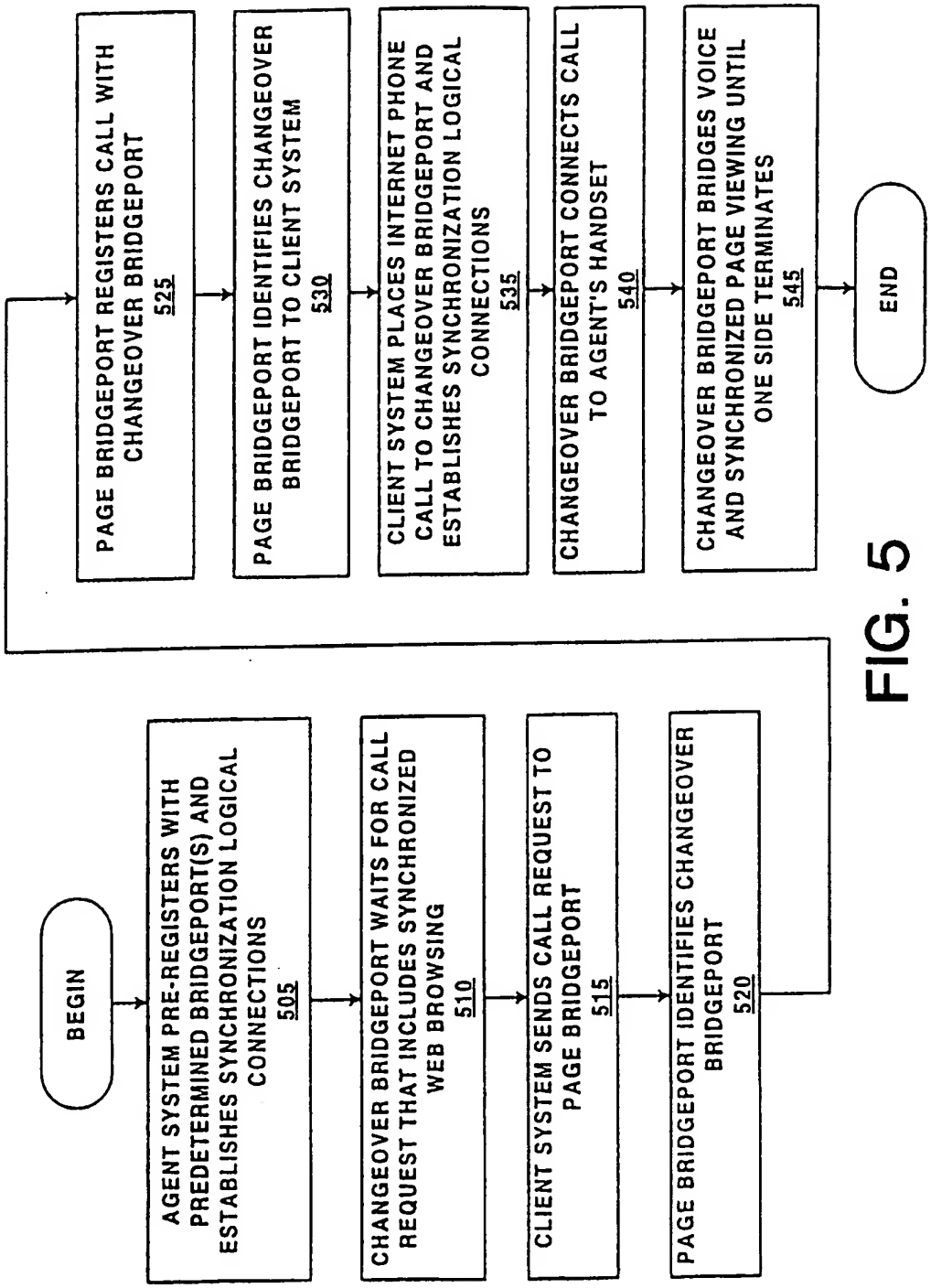
BEGIN
AGENT SYSTEM PRE-REGISTERS WITH PREDETERMINED BRIDGEPORT(S) AND ESTABLISHES SYNCHRONIZATION LOGICAL CONNECTIONS 505
CHANGEOVER BRIDGEPORT WAITS FOR CALL REQUEST THAT INCLUDES SYNCHRONIZED WEB BROWSING 510
CLIENT SYSTEM SENDS CALL REQUEST TO PAGE BRIDGEPORT 515
PAGE BRIDGEPORT IDENTIFIES CHANGEOVER BRIDGEPORT 520
PAGE BRIDGEPORT REGISTERS CALL WITH CHANGEOVER BRIDGEPORT 525
PAGE BRIDGEPORT IDENTIFIES CHANGEOVER BRIDGEPORT TO CLIENT SYSTEM 530
CLIENT SYSTEM PLACES INTERNET PHONE CALL TO CHANGEOVER BRIDGEPORT AND ESTABLISHES SYNCHRONIZATION LOGICAL CONNECTIONS 535
CHANGEOVER BRIDGEPORT CONNECTS CALL TO AGENT'S HANDSET 540
CHANGEOVER BRIDGEPORT BRIDGES VOICE AND SYNCHRONIZED PAGE VIEWING UNTIL ONE SIDE TERMINATES 545
END

FIG. 5

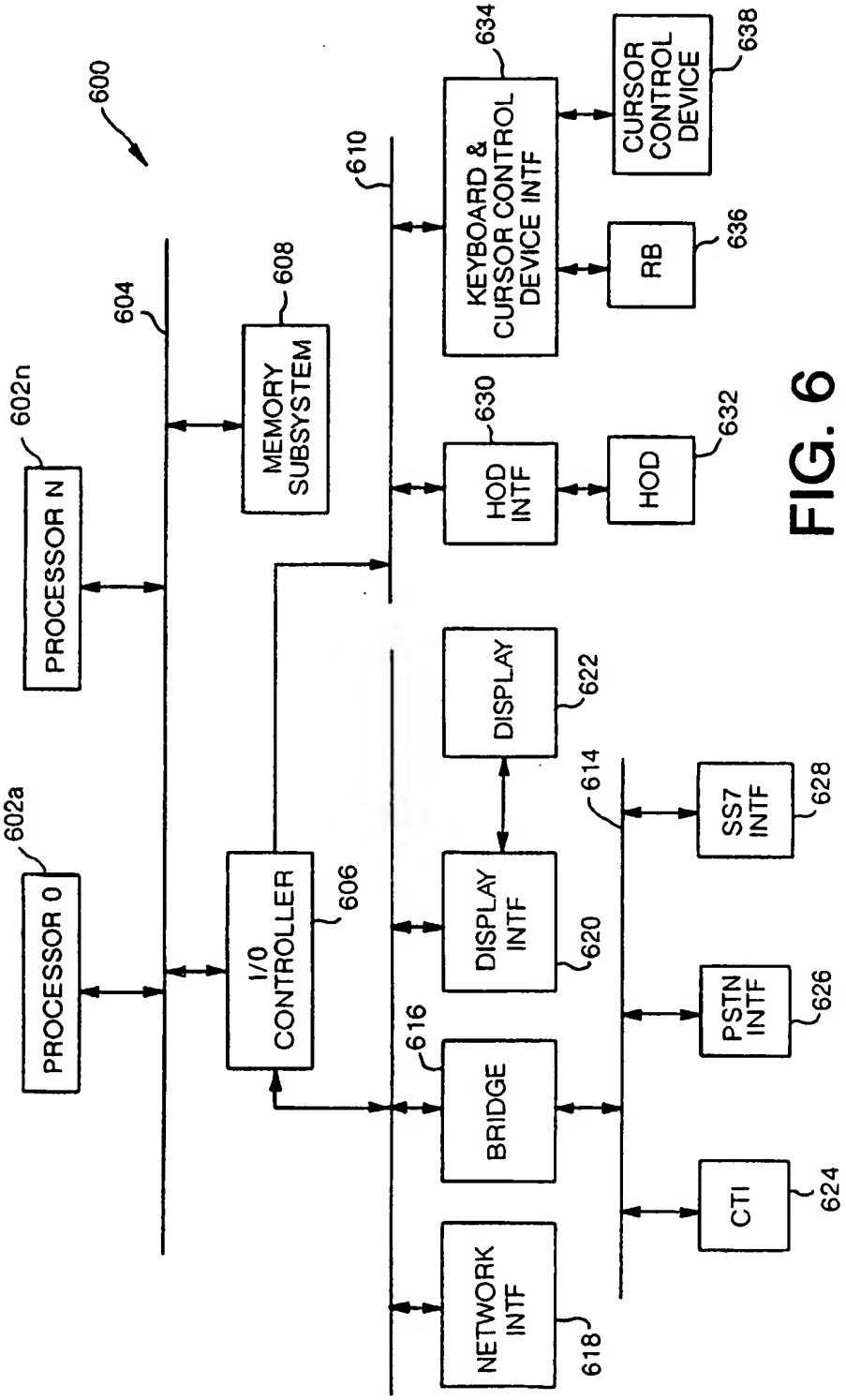
600
602a
PROCESSOR 0
602n
PROCESSOR N
604
606
I/O CONTROLLER
608
MEMORY SUBSYSTEM
610
612
614
616
BRIDGE
618
NETWORK INTF
620
DISPLAY INTF
622
DISPLAY
624
CTI
626
PSTN INTF
628
SS7 INTF
630
HOD INTF
632
HOD
634
KEYBOARD & CURSOR CONTROL DEVICE INTF
636
RB
638
CURSOR CONTROL DEVICE

FIG. 6

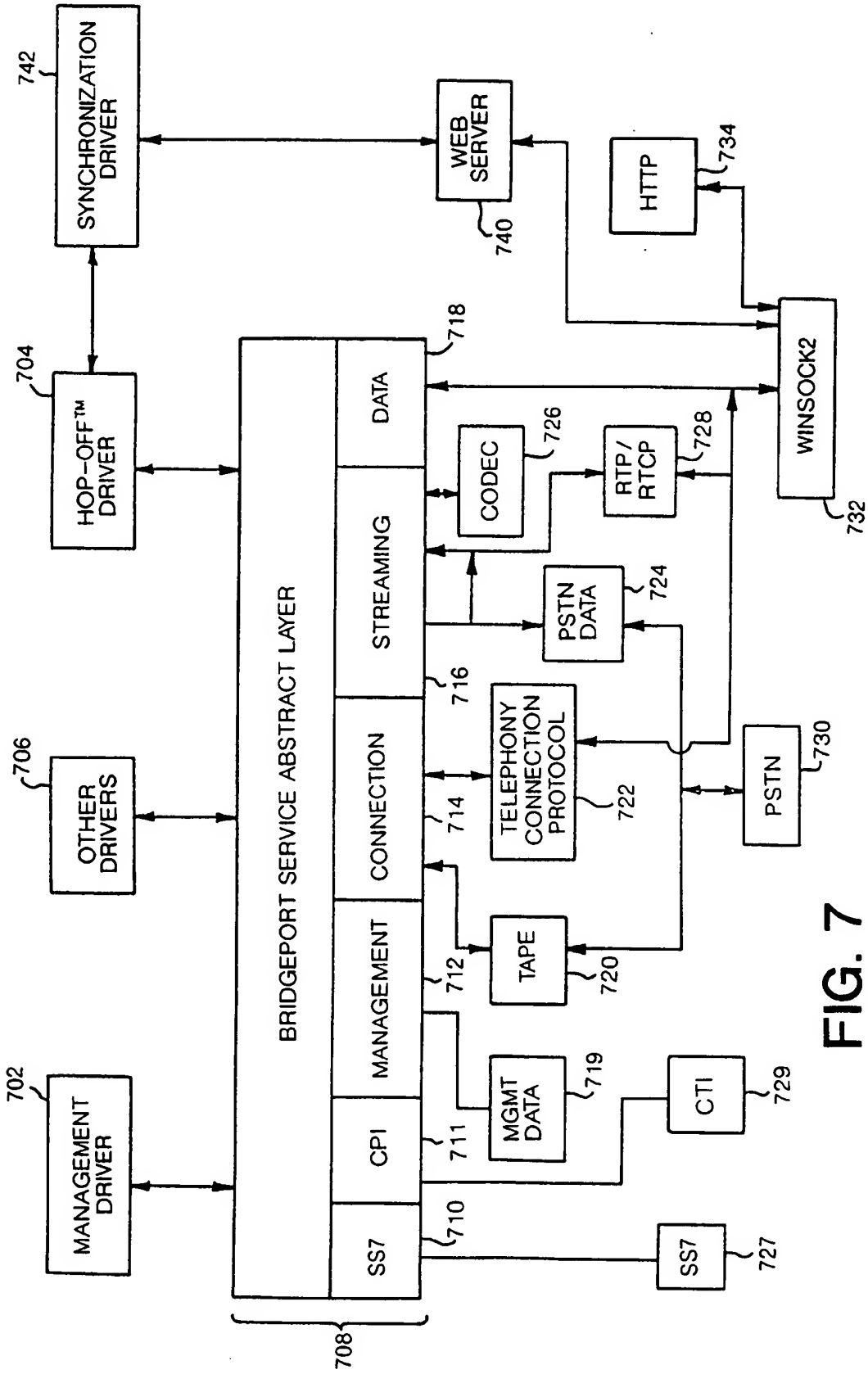
742
SYNCHRONIZATION DRIVER
WEB SERVER
740
HTTP
734
704
HOP-OFF™ DRIVER
718
DATA
STREAMING
CONNECTION
MANAGEMENT
CPI
SS7
BRIDGEPORT SERVICE ABSTRACT LAYER
708
CODEC
726
RTP/ RTCP
728
WINSOCK2
732
PSTN DATA
724
716
706
OTHER DRIVERS
714
TELEPHONY CONNECTION PROTOCOL
722
PSTN
730
712
TAPE
720
702
MANAGEMENT DRIVER
711
MGMT DATA
719
CTI
729
710
SS7
727

FIG. 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US98/04887

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :Please See Extra Sheet.
US CL :Please See Extra Sheet.
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 379/90.01, 93.01, 93.05, 93.09, 100.15, 100.16; 370/352, 353, 380, 392, 396, 401, 404, 427, 435, 450, 465, 485.

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

APS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,608,446 A (CARR ET AL.) 04 MARCH 1997, Col. 16, line 1 through Col. 17, line 62.	1-3, 5-8, 10-13, 15-16, 18-21, 23
X -- Y	US 5,526,353 A (HENLEY ET AL.) 11 June 1996, Col. 5, lines 5-21 and Col. 12, lines 6-27.	1-3, 5-8, 10-13, 15-16, 18-21, 23 ---------- 4, 9, 14, 17, 22
Y	US 4,771,425 A (BARAN ET AL.) 13 SEPTEMBER 1988, Col. 2, lines 34-46 and Figure 1.	4, 9, 14, 17, 22

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 15 JUNE 1998	Date of mailing of the international search report 25 AUG 1998
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer ALLAN HOOSAIN Telephone No. (703) 305-4012

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US98/04887

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,583,920 A (WHEELER, JR.) 10 DECEMBER 1996, Figures 3-4.	1,7, 10, 12, 16, 20.
A	US 5,696,760 A (HARDIN ET AL.) 09 DECEMBER 1997, Col. 2, lines 15-37.	1-6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US98/04887

A. CLASSIFICATION OF SUBJECT MATTER:
IPC (6):

H04M 7/10, 11/00; H04Q 11/04; H04J 1/00, 3/02, 3/16, 3/17; H04L 12/28, 12/50, 12/66, 12/403.

A. CLASSIFICATION OF SUBJECT MATTER:
US CL :

379/90.01, 93.01, 93.05, 93.09, 100.15, 100.16; 370/352, 353, 380, 392, 396, 401, 404, 427, 435, 450, 465, 485.